Summary of Dose Assessment

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The anticipated population doses for six living patterns are determined as the sum of the contributions from four exposure pathways (inhalation, external gamma-rays, marine foods, and terrestrial foods).

Six living patterns were chosen in order to evaluate the range of predicted doses from plausible cases of island habitation. Of the six, two patterns of habitation are most probable (living patterns I and III), while one pattern was chosen to be representative of an upper-limit unmodified environment (living pattern IV). A diet based upon past native habits is included in the dose assessment via the food chains. If an imported diet is adopted by the returning population, the total doses listed in this report are significantly overestimated.

Dose Assessment

The total 30-yr integral dose predicted for whole body and for bone for the six living patterns is listed in Table 204. This table includes the contributions from each pathway and, for the external dose assessment, is based upon the unmodified conditions for the village island, The largest contribution to the whole body and bone doses comes from the terrestrial food chain; the external dose pathway is the next highest contributor, while the marine food chain and inhalation pathway contribute the least,

The whole-body and bone doses range from 1. 0 and 3. 8 rem, respectively for living pattern I (where the village is on Enewetak-Parry,, and agriculture is conducted on southern islands), to 11 rem whole body and 80 rem bone for living pattern III (where the village and agriculture are on JANET), to, 31 rem whole body and 220 rem bone for living pattern IV (where the village and agriculture are confined to BELLE!). The latter living pattern is not one the people have used in the past nor that they have requested upon return; however, it represents a possible extreme exposure situation and is included for comparative purposes.

In general, living on JANET, visiting northern islands, and maintaining agriculture on northern islands (living patterns III, V, and VI) lead to significantly higher doses than if the village and agriculture are located on islands in the southern half of the Atoll (living pattern I). Doses for the same living patterns and conditions have also been calculated for 5, 10, and 70 yr and are shown in Table 205.

Table 206 shows the effect of plowing the village island and graveling the village area, i. e. , the "modified" case. For example, for living pattern III where the village is on JANET, the 30 yr integrated external exposure is reduced from 4. 0 to 1.7 rem. This comparison indicates that modifying the village island and village area by plowing and graveling does produce a significant reduction in the external exposure dose. The effect on the 5-, 10-, and 70-yr doses from modifying the village island is shown in Table 207.

The most significant contribution via the terrestrial food chain is the dose to

Table 204. The 30-yr integral dose for the six living patterns assuming unmodified conditions.

30-yr integral dose, rem
Unmodified conditions

Living pattern	Inhalation			External	Terrestrial[b]		Marine[b]		Total	
	Bone	Lung	Liver	Bone,[a] W.B.	W.B.	Bone	W.B.	Bone	W.B.	Bone
I	7(-4)	9(-4)	4(-4)	0.83	0.14	2.1	0.053	0.84	1.0	3.8
II	0.029	0.036	0.016	1.6	2.7	33	0.053	0.84	4.4	35
III	0.10	0.13	0.056	4.0	7.1	75	0.053	0.84	11	80
IV	0.47	0.59	0.25	10	21	210	0.053	0.84	31	220
V	0.11	0.13	0.058	2.9	2.7	33	0.053	0.84	5.7	37
VI	0.090	0.11	0.049	4.4	9.6	130	0.053	0.84	14	135

Living pattern	Village island	Agriculture	Visitation
I	Enewetak-Parry	ALVIN-KEITH	Southern Is.
II	Enewetak-Parry	KATE-WILMA + LEROY	Northern Is.
III	JANET	JANET	Northern Is.
IV	BELLE	BELLE	Northern Is.
V	JANET	KATE-WILMA + LEROY	Northern Is.
VI	JANET	ALICE-IRENE	Northern Is.

[a]Taken from the chapter on external dose estimates, Table 22.
[b]Based upon diet 10 yr after return, as described in the dietary and living patterns chapter.

Table 205. The 5-, 10-, 30-, and 70-yr doses for the six living patterns assuming unmodified conditions,

Living pattern	Total integral dose., rem Unmodified conditions[a]							
	5 yr[b]		10 yr[b]		30 yr[c]		70 yr[c]	
	W. B.	Bone	W. B.	Bone	W. B.	Bone	W. B.	Bone
I	0.17	0.58	0.35	1.4	1.0	3.8	2.3	8.5
II	0.48	1.3	1.1	4.3	4.4	35	8.0	68
III	1.2	2.6	2.7	9.2	11	80	20	150
Iv	3.4	6.9	7.6	25	31	220	56	420
V	0.81	1.6	1.7	4.9	5.7	37	10	71
VI	1.5	3.8.	3.3	14	14	135	25	250

[a]Taken from discussion on external dose estimates Table 22
[b]Based upon diet at time of return described in thebietary and living patterns chapter.
[c]Based upon diet 10 yr after return described in the dietary and living patterns chapter.

bone resulting from ^{90}Sr uptake via pandanus fruit, breadfruit, and coconut. For living pattern III (Table 206) for example, the total bone dose is 75 rem, of which 80% is derived from the estima ted intake of breadfruit, pandanus, and coconut. It is important to note, however, that the large contribution to the bone dose via these fruits only occurs when they are grown on northern islands. Pandanus, breadfruit, and coconut grown on the less contaminated southern islands lead to much lower dose commitments. A comparison of the dose contribution via pandanus, breadfruit, and coconut from the northern and southern half of the Atoll is shown in Table 208; predicted doses via consumption of these food items are higher by a factor of 50 when they are grown in the northern half of the Atoll, Table 209 shows the 30-yr integral dose for the six living patterns for the modified condition and with pandanus, breadfruit, and coconut grown on the southern islands; the effect of the combination of these preventive measures reduces the dose for iiving pattern III from 11 to 3.7 rem for the whole body and from 80 to 18 rem for bone (compare Tables 204 and 209). If all agriculture is confined to the southern islands then the whole-body dose is further reduced to 1.9 rem and the bone dose is 4.7 rem (see Table 210 and compare with Table 204).

A comparison of the 30-yr integral dose for living patterns I and III relative to the average United States external background dose over 30 yr is shown in Table 211. In living pattern I for whole-body exposure the integrated 30-yr dose from all pathways is less than that resulting from external U. S. background. The bone dose would be only slightly higher than U. S. background doses. For the modified case for living

Table 206. The 30-yr integral dose for the six living patterns assuming modified conditions.

Living pattern	30-yr integral dose, rem Modified conditions[a]									
	Inhalation			External	Terrestrial[c]		Marine[c]		Total	
	Bone	Lung	Liver	Bone, W.B.[b]	W.B.	Bone	W.B.	Bone	W.B.	Bone
I	3(-4)	4(-4)	2(-4)	0.83	0.14	2.1	0.053	0.84	1.0	3.8
II	0.012	0.015	6.6(-3)	1.1	2.7	33	0.053	0.84	3.9	35
III	0.045	0.056	0.024	1.7	7.1	75	0.053	0.84	8.9	78
IV	0.092	0.11	0.050	3.3	21	210	0.053	0.84	24	215
V	0.045	0.056	0.024	1.6	2.7	33	0.053	0.84	4.4	35
VI	0.058	0.072	0.031	3.1	9.6	130	0.053	0.84	13	135

[a] Modified by graveling the village area and by plowing the village island.
[b] Taken from chapter on external dose estimates, Table 22.
[c] Based upon diet 10 yr after return described in the dietary and living patterns chapter.

Table 207. The 5-, 10-, 30-, and 70-yr doses for the six living patterns assuming modified conditions.

Living pattern--	Total integral dose, rem Modified conditions[a] 5 yr[b] W.	B. Bone	10 yr[b] W.	B. Bone	30 yr[c] W.	B. Bone	70 yr[c] W.	B. Bone
I	0. 17	0. 58	0. 35	1. 4	1.0'	3.8	2. 3	8.5
II	0. 48	1. 3'	1. 1	4. 3	3.9	35	8.0	68
III	0.60	2.1	1. 7	8.2	8. 9	78	16	150
IV	1.5	5.0	4. 3	22	24	215	46	410
v	0.46	1.3	1.0	4. 3	4.4	35	8.0	68
VI	1. 1	3.4	2.7	13	13	135	23	250

[a]Taken from discussion on external dose estimates, Table 22.
[b]Based upon diet at time of return described in the dietary and living patterns chapter,
[c]Based upon diet 10 yr after return described in the dietary and living patterns chapter.

Table 208. Bone dose from ^{90}Sr via pandanus. breadfruit, and coconut.

Location	30-yr integral dose, rem[a] Intake of pandanus, breadfruit, and coconut.
Southern islands	1.2
Northern islands[b]	63

[a]Based upon diet 10 yr after return discussed in dietary and living patterns chapter.
[b]Average of northern island groups I, II, and III.

pattern III, with agriculture conducted on' northern islands, the 30-yr integrated dose from all pathways is higher than U. S. background by a factor of three for whole body and by nearly a factor of 26 for bone. However, if for living pattern III the modified case is considered and agriculture is confined to southern islands, then the whole body dose is 1. 9 rem, less than U. S. background, and the bone dose in 4. 7 rem, which is approximately 1. 5 times the U. S. external background dose.

Of the three pathways contributing to whole body-exposure, the marine pathway contributes the least. Tables 204 and 206 indicate the relative importance. As was mentioned in the discussion of the marine pathway dose assessment, the fish from the island group ALICE through IRENE have a higher concentration of ^{137}Cs and ^{60}Co than fish from the rest of the Atoll, but the men would not fish exclusively off these islands. However, if such a practice were adopted, the whole-body dose via

Table 209. The 30-yr integral dose for the six living patterns assuming modified conditions and agriculture on the southern islands.

	30-yr integral dose, rem									
	Modified conditions[a] and pandanus, breadfruit, coconut, and tacca grown on southern islands									
	Inhalation			External	Terrestrial[c]		Marine[c]		Total	
Living pattern	Bone	Lung	Liver	Bone, W.B.[b]	W.B.	Bone	W.B.	Bone	W.B.	Bone
I	3(-4)	4(-4)	2(-4)	0.83	0.14	2.1	0.053	0.84	1.0	3.8
II	0.012	0.015	0.0066	1.1	0.77	7.1	0.053	0.84	1.9	9.1
III	0.045	0.056	0.024	1.7	1.9	15	0.053	0.84	3.7	18
IV	0.092	0.11	0.050	3.3	5.7	39	0.053	0.84	9.1	43
V	0.045	0.056	0.024	1.6	0.77	7.1	0.053	0.84	2.4	9.6
VI	0.058	0.072	0.031	3.1	2.5	23	0.053	0.84	5.7	27

[a]Modified by graveling the village area and by plowing the village island.
[b]Taken from chapter on external dose estimates, Table 22.
[c]Based upon diet 10 yr after return described in dietary and living patterns chapter.

Table 210. The 30-yr integral dose for the six living patterns assuming modified conditions and agriculture on the southern islands.

Living pattern	30-yr integral dose, rem: Modified conditions[a] and agriculture on southern islands									
	Inhalation			External	Terrestrial[c]		Marine[c]		Total	
	Bone	Lung	Liver	Bone, W.B.[b]	W.B.	Bone	W.B.	Bone	W.B.	Bone
I	3(-4)	4(-4)	2(-4)	0.83	0.14	2.1	0.053	0.84	1.0	3.8
II	0.012	0.015	0.0066	1.1	0.14	2.1	0.053	0.84	1.3	4.1
III	0.045	0.056	0.024	1.7	0.14	2.1	0.053	0.84	1.9	4.7
IV	0.092	0.11	0.050	3.3	0.14	2.1	0.053	0.84	3.5	6.3
V	0.045	0.056	0.024	1.6	0.14	2.1	0.053	0.84	1.8	4.6
VI	0.058	0.072	0.031	3.1	0.14	2.1	0.053	0.84	3.3	6.1

[a]Modified by graveling the village area and by plowing the village island.
[b]Taken from chapter on external dose estimates, Table 22.
[c]Based upon diet 10 yr after return described in dietary and living patterns chapter.

Table 211. The 30-yr integral dose from all pathways compared to U. S. external background dose.

Location	30-yr integral dose,[a] rem			
	Unmodified case		Modified case	
	Whole body	Bone	Whole body	Bone
Enewetak Atoll Living pattern I	1.0	3.8	1.0	3.8
Enewetak Atoll Living pattern III	11	80	8.9	78
Enewetak Atoll Living pattern III, agriculture confined to southern islands	4.2	7.0	1.9	4.7
U. S. background only[b]	3.0	3.0	3,0.	3.0

[a] Sum of all pathways for the Enewetak living patterns (i. e., external, inhalation, marine, and terrestrial).
[b] Based upon background of 100 mrem/yr at sea level.

the marine pathway would increase by nearly a factor of five, while the bone dose would increase by nearly a factor of two. This would still make the whole-body dose contributions via the marine pathway much less significant than the external and the terrestrial pathways.

The major concern via the inhalation pathway is the absorption of plutonium into the lung and subsequently into the liver and bone. The lung, bone, and liver doses for the six living patterns are listed in Table 204 for the unmodified case and in Table 206 for modified conditions. This pathway contributes the least of all pathways to the bone dose. For living pattern I and unmodified conditions, the 30-yr integral dose to the lung is less than 1 mrem. The lung, bone, and liver doses via the inhalation pathway increase if residence, agriculture, and visitation occur primarily on the northern islands. For living pattern III, for example, the lung, bone, and liver, 30-yr integral doses are 0. 13, 0. 10, and 0.056 rem, respectively.

For the modified case, shown in Table 206, the northern islands still predominate over the southern islands as potential contributors via the inhalation pathway; however, for living pattern III the 30-yr doses are nearly an order of magnitude lower than in the unmodified case (lung = 0.056 rem, bone = 0.045 rem, and liver. = 0. 024 rem).

Plutonium isotopes, because of their long half-life, will still be present when the other major isotopes observed at the Atoll have decayed away. Therefore, Tables 212 and 213 are included to show the predicted doses from plutonium to the three major receptor organs (lung, liver and bone) via the three relevant exposure pathways. It is clear, accepting the assumptions made in assessing the pathways, that the potential dose from plutonium is Pow vi? all pathways,

Discussion

It is appropriate to briefly examine the major components of most significance to the radiological dose assessment of the Atoll. They are:

- The significant radionuclides.
- The relative importance of each pathway.
- The ensemble of living patterns.
- Remedial action.

Significant Radionuclides — While there are a large number of radionuclides present in the Enewetak environment, four radionuclides (^{90}Sr, ^{137}Cs, ^{60}Co, and ^{239}Pu contribute nearly all of the population dose. This is the result of the combination of long half-life, large inventory, and relative importance of the radionuclides in the four pathways, ^{137}Cs and ^{60}Co are the major contributions to the external gamma dose, but both also contribute to the total dose via the food chains. The 5-, 10-, 30- and 70-yr doses via all pathways are calculated assuming that disappearance of the nuclides from the Atoll environment is by radioactive decay only. The possibility of the rate of removal being more rapid due to other processes such as penetration of the soil surface with time and runoff into the lagoon and ocean is not accounted for in the dose codes. Thus, to the extent that such time-dependent processes are important in increasing the rate disappearance of radionuclides from the environment, the dose estimates are upper limits.

^{90}Sr is of major importance in the food chains. In particular, it contributes the major portion of the bone dose via the terrestrial and marine food chains and is the limiting isotope for the terrestrial food chain and the Atoll. Observations from both soil data and marine data collected during the survey indicate that ^{90}Sr is turning over more slowly in the Atoll environment than is ^{137}Cs.

Plutonium is present in substantial amounts in the northern part of the Atoll and in the lagoon. In the southern half of the Atoll the concentration levels are essentially that of world-wide background, ^{239}Pu is the dominant nuclide, with ^{238}Pu accounting for 10% of the total plutonium. The major pathway for plutonium is the inhalation pathway for living patterns involving northern islands, while for the southern islands plutonium contributes similarly through all pathways. Over 70 yr, however, the dose contribution from plutonium is very small relative ^{90}Sr ^{60}Co, and ^{137}Cs

Relative Importance of Pathways — The relative ranking of the pathways in their contribution to the total dose for most living patterns is as follows:

(1) Terrestrial food chain
(2) External gamma
(3) Marine food chain
(4) Inhalation

The terrestrial food chain can potentially contribute far greater doses than the other three pathways.

The Ensemble of Living Patterns-Two living patterns (I and II) have, been requested by the returning population. For living pattern I (village and agriculture on the southern islands) the 30-yr

Table 212. The plutonium 30-yr integral dose to bone, liver, and lung via the three exposure pathways. This table assumes modified conditions.

Living pattern	Plutonium 30-yr integral dose, rem Modified conditions											
	Marine			Terrestrial[a]			Inhalation			Total		
	Bone	Liver	Lung	Bone	Liver	Lung	Bone	Liver	Lung	Bone	Liver	Lung
I	0.018	0.047	-	5.0(-5)	1.8(-4)	-	3(-4)	2(-4)	4(-4)	0.018	0.047	4(-4)
II	0.018	0.047	-	1.5(-3)	5.0(-3)	-	0.012	0.0066	0.015	0.032	0.057	0.015
III	0.018	0.047	-	6.9(-3)	5.3(-3)	-	0.045	0.024	0.056	0.070	0.076	0.056
IV	0.018	0.047	-	3.0(-3)	0.010	-	0.092	0.050	0.11	0.11	0.11	0.11
V	0.018	0.047	-	5.0(-5)	1.8(-4)	-	0.045	0.024	0.056	0.063	0.071	0.056
VI	0.018	0.047	-	3.0(-3)	0.010	-	0.058	0.031	0.072	0.079	0.088	0.072

[a]Based upon diet 10 yr after return discussed in chapter on dietary and living patterns.

Table 213. The plutonium 30-yr integral dose to bone, liver, and lung via the three exposure pathways. This table assumes unmodified conditions on the village island.

Plutonium 30-yr integral dose, rem Unmodified conditions												
Living pattern	Marine			Terrestrial[a]			Inhalation			Total		
	Bone	Liver	Lung	Bone	Liver	Lung	Bone	Liver	Lung	Bone	Liver	Lung
I	0.018	0.047	-	5.0(-5)	1.8(-4)	-	7(-4)	4(-4)	9(-4)	0.018	0.048	9(-4)
II	0.018	0.047	-	1.5(-3)	5.0(-3)	-	0.029	0.016	0.036	0.049	0.068	0.036
III	0.018	0.047	-	6.9(-3)	5.3(-3)	-	0.10	0.056	0.13	0.12	0.11	0.13
IV	0.018	0.047	-	3.0(-3)	0.010	-	0.47	0.25	0.59	0.49	0.31	0.59
V	0.018	0.047	-	5.0(-5)	1.8(-4)	-	0.11	0.058	0.13	0.13	0.11	0.13
VI	0.018	0.047	-	3.0(-3)	0.010	-	0.090	0.049	0.11	0.11	0.11	0.11

[a]Based upon diet 10 yr after return discussed in chapter on dietary and living patterns.

integral whole-body and bone doses from all pathways are 1. 0 and 3.8 rem respectively, comparable to average United-. States 30-yr integral external background doses for 3 rem. For-living pattern III (village on Engebi and agriculture on northern islands) withdut' any modification, the 30-yr integral whole-body dose is 11 rem and the bone dose 80 rem. Other living patterns involving northern islands and without modification have 30-yr, whole-body doses ranging from 4 to 30 rem and bone doses ranging from 35 to 220 rem.

Remedial Action

Terrestrial Food Chain-The doses estimated for the various living patterns indicate that careful assessment and design of an agricultural plan must be an integral part of the program plan for returning people to the Atoll. For example, the southern half of the Atoll has sufficient land area to supply pandanus, breadfruit, and coconut for the entire returning oooulation; therefore, even if people were to live on Engebi, the dose commitment could be greatly reduced by confining agriculture to the southern half of the Atoll. This one restriction, expecially for pandanus, breadfruit,. and coconut would be the single most effective preventive measure for reducing the dose commitment. The combination of modifying the village island and living area and, confining the agriculture to the southern islands. 'both relatively easy to' implement, have a, very large impact on reducing the dose (compare Tables 204 and 210).

There are, of course, other options for reducing the dose via the terrestrial pathway. One option would be to dig large area pits on all islands which would be filled with "clean" soil from another source; pandanus, breadfruit, coconut and other plants could then be grown and harvested from these "clean" soil areas throughout the Atoll. The subsequent reduction in dose would lead to doses from ^{90}Sr equivalent to or less than those predicted for the southern islands. Another option would include removing the surface layer of soil (O-20 cm) from the northern islands and replacing it with uncontaminated' topsoil. This approach should also lead to doses equal to or less than those predicted for the southern islands, This form of remedial action would in the process reduce the dose via the inhalation pathway, This alternative, of course, requires the removal and disposition of an enormous amount of soil, and ocean dumping, which would provide the large reservoir needed and minimize the potential man-rem, would probably be the best and easiest method of disposal. This approach is certainly not one of the easier alternatives.

Efforts to maintain a high calcium diet could also be implemented to reduce the uptake o f ^{90}Sr; however, remedial measures to reduce the uptake in the plants or food product would be more effective and desirable as the primary preventive measure.

Of course, the dose commitment would be largely eliminated if no pandanus, breadfruit, 'or coconut were planted on the Atoll for another 20 to 30 yr and if the diet were to consist of predominantly

imported food. As was discussed in the chapter on dietary and living patterns, imported foods are very likely to form a significant fraction of the diet (possibly 85% or more) and, if so, a plan to control the production of pandanus and breadfruit, or at least the location of production, could essentially reduce dose commitments to levels near U. S. external background.

External Dose — The integral 30 yr external dose is reduced between 30 and 70% for. living patterns III, IV;' V, and VI as a result of plowing the, village island and graveling the village area where people will spend a majority of their time. These procedures are fairly straightforward, relatively easy to implement, and lead to the largest percentage reduction in external dose. An additional reduction in external dose of approximately 16% could be attained if all islands were plowed; however, implementing such a program in order to achieve the additional slight reduction is certainly another order-of-magnitude problem. In any case, any plan to plow all islands would have to receive careful scrutiny to determine the possible effects upon the island and Atoll ecology.

Marine Food Chain — The marine food chain would appear to require no remedial action (see marine food chain chapter). The marine pathway contribution to the 30-yr integral dose for the modified case and for agriculture on southern islands (Table 2 10) is less than 4% for whole unmodified conditions; the percentage is far less than these. The concentration of radionuclides in fish muscle is higher in fish around the ALICE -to-IRENE complex, but even if the fishing were confined to these islands, a completely unrealistic fishing pattern, the resulting 30-yr, whole-body and bone doses would still be less significant than the other pathways and less than the 30 yr integral U. S. background dose.

Inhalation Pathway — The dose commitment via the inhalation pathway is due to the presence of plutonium throughout the soil in all of the northern islands. It is not generally localized sufficiently to consider "spot" cleanup, Anything short of removing the top layer of soil and r&placing it with uncontaminated soil, or of simply covering existing soil with new soil, or of restricting living on northern islands will have little effect on the dose commitments via the inhalation pathway presented in this chapter. However, it should be noted that the plutonium concentrations on the southern islands are world-wide background levels, and the corresponding dose via the inhalation pathway is less than 1 mrem over 30 yr. This is the same level of exposure one would expect if new soil were brought in to the northern islands. The doses via inhalation on the northern islands is also insignificant relative to other pathways, where remedial action would be far more productive. (See Tables 204 and 206).

Summary of Remedial Action — In summary, the greatest reduction in dose commitment can be realized by developing a carefully designed. agricultural plan and limiting the dose via the terrestrial food chains. The next most effective measure would be directed at the external dose commitment by plowing the village island and graveling the village area. Other remedial measures for reducing the dose commitment via the different pathways are possible but reduce the potential dose commitment by far lesser amounts.

YVONNE (Runit) — The island of YVONNE (Runit) is a unique situation among all of the Atoll islands. "Hot spots" of nearly pure plutonium exist throughout the northern part of the island; milligram-size plutonium particles are present and presumably inhalable micron-size particles are also present. The potential health hazard via the inhalation pathway due to the large plutonium inventory is sufficiently great to dictate two basic alternatives for remedial action for this island: (1) make the entire island an exclusion area — off limits to all people, or (2) conduct a cleanup campaign which will eliminate the "hot-spot" plutonium problem and remove whatever amount of soil is necessary to reduce the soil plutonium concentration to a level comparable to the southern half of the island which has soil concentrations similar to other northern islands. If the latter action were taken, the islandcould be considered in the overall design for remedial action for the northern islands.

Dose Estimates for Other Assumed Living Patterns — The tables in each section of this chapter describing the dose via a specific pathway (i. e. , external, terrestrial, and marine) are presented in a manner in which any combination of living pattern, time distribution, diet, and agricultural pattern can be assumed, and the corresponding dose predicted. We have chosen for dose assessment and presentation in this report the most likely living patterns (I, II, III, V), the most likely distribution of time, the most likely use of islands for agriculture, and the most likely fishing practices. We have also presented two living patterns which represent more extreme possibilities (living patterns IV and VI), although neither has been used in the past nor requested presently by the potential returning population. However, any other desired combination of living pattern and living habits could be assessed from data presented in the report.